



IB Demystified

Mathematics: Applications and Interpretation SL

Paper 1 Mock Examination

Mock Exam 3

Calculator: A graphic display calculator (GDC) is required

Time allowed: 1 hour 30 minutes

Maximum mark: 80 marks

Instructions to Candidates

- Do not open this examination paper until you are told to begin.
- A graphic display calculator is needed throughout this paper.
- A clean copy of the *Mathematics: Applications and Interpretation SL* formula booklet may be used.
- Answer every question. Write your responses in the answer spaces provided.
- Unless a question states otherwise, give numerical answers either exactly or rounded correct to three significant figures.
- Any answer obtained from a calculator must be supported by suitable working, a clear setup, a sketch, or an explanation.
- If you solve a problem using a graph, include a sketch or a clear description of the graphing method used.
- Unsupported answers may not receive full marks, so you are advised to show all of your working.
- The maximum mark for this paper is **80 marks**.
- The time allowed for this paper is **1 hour 30 minutes**.

Candidate name:	
Session number:	
Date:	

This paper consists of 13 questions. The marks for each question are shown in brackets.

1.

[Maximum mark: 6]

A librarian records the number of books borrowed in one month by each of 40 students. The results are shown in the frequency table.

Number of books	0	1	2	3	4	5
Frequency	3	7	11	9	6	4

(a) Find the mean number of books borrowed. [2]

.....

.....

(b) Write down the median number of books borrowed. [2]

.....

.....

(c) Find the standard deviation. [1]

.....

(d) Find the percentage of students who borrowed at least 3 books. [1]

.....

2.

[Maximum mark: 5]

The time, t hours, needed to assemble a batch of furniture is inversely proportional to the number of workers, n . When 6 workers are used, the task takes 14 hours.

(a) Find an equation relating t and n . [2]

.....

.....

(b) Find the time taken when 8 workers are used. [1]

.....

(c) Find the number of workers needed to complete the task in 7 hours. [2]

.....

.....

3.

[Maximum mark: 5]

An electricity company charges for monthly usage of u kilowatt-hours (kWh) according to

$$C(u) = \begin{cases} 0.18u, & 0 \leq u \leq 200, \\ 36 + 0.27(u - 200), & u > 200, \end{cases}$$

where C is the cost in dollars.

(a) Find the cost for a household that uses 150 kWh. [1]

.....

(b) Find the cost for a household that uses 320 kWh. [2]

.....

.....

(c) A household receives a bill of \$63. Find the number of kilowatt-hours used. [2]

.....

.....

4.

[Maximum mark: 4]

A bag contains 5 red marbles and 3 blue marbles. Two marbles are drawn at random, one after the other, **without replacement**.

(a) Find the probability that both marbles are red. [2]

.....

.....

(b) Find the probability that the two marbles are different colours. [2]

.....

.....

5.

[Maximum mark: 7]

A company records the number of years of experience, x , and the annual salary, y (in thousands of dollars), of eight employees.

Experience, x (years)	1	3	4	6	8	9	11	12
Salary, y (\$1000)	32	38	41	47	53	55	62	66

(a) Find Pearson's product-moment correlation coefficient, r . [1]

.....

(b) Find the equation of the regression line of y on x . [2]

.....

.....

(c) Interpret the gradient of the regression line in this context. [1]

.....

(d) Use the regression line to estimate the salary of an employee with 7 years of experience. [2]

.....

.....

(e) Explain whether the regression line should be used to estimate the salary of an employee with 30 years of experience. [1]

.....

.....

6.

[Maximum mark: 6]

A pile of sand is in the shape of a right circular cone with base radius 2.4 m and vertical height 1.8 m.

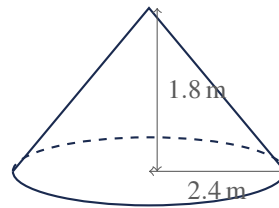


Diagram not to scale

- (a) Find the slant height of the cone. [1]

.....

- (b) Find the volume of the sand. [2]

.....

.....

- (c) Find the total surface area of the cone, including its circular base. [2]

.....

.....

- (d) The sand is shovelled into cylindrical bags of radius 0.18 m and height 0.35 m. Find the maximum number of bags that can be completely filled. [1]

.....

.....

7.

[Maximum mark: 5]

In a fairground game, a player's net gain $\$X$ has the probability distribution shown.

x	-2	0	3	5
$P(X = x)$	0.4	k	0.2	0.1

- (a) Find the value of k . [1]

.....

- (b) Find the expected net gain $E(X)$. [2]

.....

.....

(c) State, with a reason, whether the game is favourable to the player. [2]

.....

.....

8.

[Maximum mark: 7]

A solid right pyramid has a square base $ABCD$ of side 8 cm. The apex V is positioned directly above the centre M of the base, at a height of 10 cm.

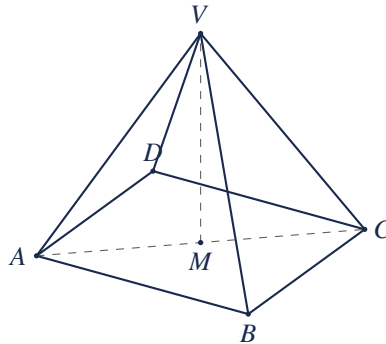


Diagram not to scale

(a) Find the distance MC from the centre of the base to a corner.

[2]

.....

.....

(b) Find the length of a slant edge VC .

[2]

.....

.....

(c) Find the angle between the slant edge VC and the base.

[3]

.....

.....

.....

9.

[Maximum mark: 4]

The following seven values give the daily number of customer complaints received by a call centre over one week:

12, 15, 15, 18, 20, 22, 40.

(a) Find the median and the interquartile range of the data.

[2]

.....

.....

(b) An outlier is defined as a value greater than $Q_3 + 1.5 \times \text{IQR}$. Determine whether 40 is an outlier.

[2]

.....

.....

10.

[Maximum mark: 7]

A conservation team models the rate of change of a fish population in a lake. The rate, R fish per year, t years after monitoring begins, is

$$R(t) = 80 - 6t, \quad 0 \leq t \leq 20.$$

(a) Find the value of $R(5)$. [1]

.....

(b) Find the time at which the population stops increasing. [2]

.....

.....

(c) Find $\int_0^{10} R(t) dt$ and interpret your answer in context. [3]

.....

.....

(d) State one limitation of this model. [1]

.....

.....

11.

[Maximum mark: 5]

A car is bought for \$28 000. Its value decreases by 14% each year.

(a) Find the value of the car after 3 years, to the nearest dollar. [2]

.....

.....

(b) Find the number of complete years after which the car is first worth less than \$10 000. [2]

.....

.....

(c) State one limitation of this model of depreciation. [1]

.....

.....

A company produces x hundred units of a product per week. The weekly cost, in hundreds of dollars, is $C(x) = 2x^2 + 15x + 120$ and the weekly revenue, in hundreds of dollars, is $R(x) = -x^2 + 90x$.

(a) Show that the weekly profit is $\Pi(x) = -3x^2 + 75x - 120$. [2]

.....
.....

(b) Find the number of units that maximises the weekly profit, and justify that it is a maximum. [3]

.....
.....
.....

(c) Find the maximum weekly profit, in dollars. [2]

.....
.....

(d) Find the values of x for which the company breaks even. [2]

.....
.....

A manufacturer makes closed cylindrical cans, each with a volume of 500 cm^3 . The radius of a can is r cm and its height is h cm.

(a) Show that the total surface area of a can is

$$A = 2\pi r^2 + \frac{1000}{r}.$$

[2]

.....

(b) Find $\frac{dA}{dr}$.

[2]

.....

(c) Find the radius that minimises the surface area.

[2]

.....

(d) Find the minimum surface area of a can.

[2]

.....

(e) State one assumption of this model that may not hold for real cans.

[1]

.....

END OF EXAMINATION